~~525. The method of claim 491, wherein allowing the heat to transfer comprises~~ increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

526. The method of claim 491, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

527. The method of claim 491, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

528. The method of claim 491, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

529. The method of claim 491, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

530. The method of claim 491, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated ~~over an area of the formation to form a repetitive pattern of units.~~

SJb23 ~~531. A method of treating a hydrocarbon containing formation in situ, comprising:~~

providing heat from one or more ~~heat sources to~~ at least a portion of the formation;

allowing ~~the heat~~ to transfer from the one or more heat sources to a selected section of the formation; and

controlling a pressure and a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure; and

producing a mixture from the formation.

532. The method of claim 531, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

533. The method of claim 531, wherein controlling formation conditions comprises maintaining a temperature within the selected section within a pyrolysis temperature range.

534. The method of claim 531, wherein the one or more heat sources comprise electrical heaters.

535. The method of claim 531, wherein the one or more heat sources comprise surface burners.

536. The method of claim 531, wherein the one or more heat sources comprise flameless distributed combustors.

537. The method of claim 531, wherein the one or more heat sources comprise natural distributed combustors.

538. The method of claim 531, further comprising controlling the heat such that an average heating rate of the selected section is less than about 1 °C per day during pyrolysis.

539. The method of claim 531, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon-containing formation from the one or more heat sources, wherein the formation has an average heat capacity (Cv), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

540. The method of claim 531, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

541. The method of claim 531, wherein providing heat from the one or more heat sources comprises heating the selected section such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C).

542. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

543. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

544. The method of claim 531, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

545. The method of claim 531, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

546. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

547. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

548. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

549. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

550. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

551. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

552. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

553. The method of claim 531, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

~~554. The method of claim 531, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.~~

555. The method of claim 531, wherein the produced mixture comprises ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

556. The method of claim 531, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

557. The method of claim 531, wherein the controlled pressure is at least about 2.0 bar absolute.

558. The method of claim 531, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar.

~~559. The method of claim 531, wherein the partial pressure of H_2 is measured when the mixture is at a production well.~~

560. The method of claim 531, further comprising altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

561. The method of claim 531, wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation.

562. The method of claim 531, further comprising:

providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and

heating a portion of the section with heat from hydrogenation.

563. The method of claim 531, wherein the produced mixture comprises hydrogen and condensable hydrocarbons, the method further comprising hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

564. The method of claim 531, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

565. The method of claim 531, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

566. The method of claim 531, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

567. The method of claim 531, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

568. The method of claim 531, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

569. The method of claim 531, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

570. A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more heat sources to at least a portion of the formation;

allowing the heat to transfer from the one or more heat sources to a selected section of the formation to raise an average temperature within the selected section to, or above, a temperature that will pyrolyze hydrocarbons within the selected section;

producing a mixture from the formation; and

controlling API gravity of the produced mixture to be greater than about 25 degrees API by controlling average pressure and average temperature in the selected section such that the average pressure in the selected section is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the selected section:

$$p = e^{[-44000/T + 67]}$$

where p is measured in psia and T is measured in ° Kelvin.

571. The method of claim 570, wherein the API gravity of the produced mixture is controlled to be greater than about 30 degrees API, and wherein the equation is:

$$p = e^{[-31000/T + 51]}.$$

572. The method of claim 570, wherein the API gravity of the produced mixture is controlled to be greater than about 35 degrees API, and wherein the equation is:

$$p = e^{[-22000/T + 38]}.$$

573. The method of claim 570, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

574. The method of claim 570, wherein controlling the average temperature comprises maintaining a temperature in the selected section within a pyrolysis temperature range.

575. The method of claim 570, wherein the one or more heat sources comprise electrical heaters.

576. The method of claim 570, wherein the one or more heat sources comprise surface burners.

577. The method of claim 570, wherein the one or more heat sources comprise flameless distributed combustors.

578. The method of claim 570, wherein the one or more heat sources comprise natural distributed combustors.

579. The method of claim 570, further comprising controlling a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

580. The method of claim 570, further comprising controlling the heat such that an average heating rate of the selected section is less than about 1 °C per day during pyrolysis.

581. The method of claim 570, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

582. The method of claim 570, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

583. The method of claim 570, wherein providing heat from the one or more heat sources comprises heating the selected section such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C).

584. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

585. The method of claim 570, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

586. The method of claim 570, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

587. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

588. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

589. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

590. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

591. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

592. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

593. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

594. The method of claim 570, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

595. The method of claim 570, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

596. The method of claim 570, wherein the produced mixture comprises ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

597. The method of claim 570, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

598. The method of claim 570, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar.

599. The method of claim 570, wherein the partial pressure of H_2 is measured when the mixture is at a production well.

600. The method of claim 570, further comprising altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

601. The method of claim 570, wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation.

602. The method of claim 570, further comprising:

providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and

heating a portion of the section with heat from hydrogenation.

603. The method of claim 570, wherein the produced mixture comprises hydrogen and condensable hydrocarbons, the method further comprising hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

604. The method of claim 570, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

605. The method of claim 570, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

606. The method of claim 570, wherein the heat is controlled to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

607. The method of claim 570, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

608. The method of claim 570, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

Sub C/4)

609. The method of claim 570, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

Sub D/6)

610. A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat to at least a portion of a hydrocarbon containing formation such that a temperature (T) in a substantial part of the heated portion exceeds 270 °C and hydrocarbons are pyrolyzed within the heated portion of the formation;

controlling a pressure (p) within at least a substantial part of the heated portion of the formation;

wherein $p_{bar} > e^{[(-A/T)+B-2.6744]}$;

wherein p is the pressure in bar absolute and T is the temperature in degrees K, and A and B are parameters that are larger than 10 and are selected in relation to the characteristics and composition of the hydrocarbon containing formation and on the required olefin content and carbon number of the pyrolyzed hydrocarbon fluids; and

producing pyrolyzed hydrocarbon fluids from the heated portion of the formation.

611. The method of claim 610, wherein A is greater than 14000 and B is greater than about 25 and a majority of the produced pyrolyzed hydrocarbon fluids have an average carbon number lower than 25 and comprise less than about 10 % by weight of olefins.

612. The method of claim 610, wherein T is less than about 390 °C, p is greater than about 1.4 bar, A is greater than about 44000, and b is greater than about 67, and a majority of the produced pyrolyzed hydrocarbon fluids have an average carbon number less than 25 and comprise less than 10 % by weight of olefins.

613. The method of claim 610, wherein T is less than about 390 °C, p is greater than about 2 bar, A is less than about 57000, and b is less than about 83, and a majority of the

produced pyrolyzed hydrocarbon fluids have an average carbon number lower than about 21.

614. The method of claim 610, further comprising controlling the heat such that an average heating rate of the heated portion is less than about 3°C per day during pyrolysis.

615. The method of claim 610, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

616. The method of claim 610, wherein heat is transferred substantially by conduction from one or more heat sources located in one or more heat sources to the heated portion of the formation.

617. The method of claim 616, wherein the heat sources comprise heaters in which hydrocarbons are either injected into a heaters or released by the hydrocarbon containing formation adjacent to a heater by an oxidant injected into the heater in or adjacent to which the combustion occurs and wherein at least part of the produced combustion gases are vented to surface via the heater in which the combustion occurs.

618. The method of claim 617, wherein heat is transferred substantially by conduction from one or more heat sources to the heated portion of the formation such that the thermal conductivity of at least part of the heated portion is substantially uniformly modified to a value greater than about 0.6 W/m °C and the permeability of said part increases substantially uniformly to a value greater than 1 Darcy.

619. The method of claim 610, further comprising controlling formation conditions to produce a mixture of hydrocarbon fluids and H_2, wherein a partial pressure of H_2 within the mixture flowing through the formation is greater than 0.5 Bar.

620. The method of claim 619, further comprising, hydrogenating a portion of the produced pyrolyzed hydrocarbon fluids with at least a portion of the produced hydrogen and heating the fluids with heat from hydrogenation .

621. The method of claim 610, wherein the hydrocarbon containing formation is a coal seam and at least about 70% of the hydrocarbon content of the coal, when such hydrocarbon content is measured by a Fischer assay, is produced from the heated portion of the formation.

622. The method of claim 610, wherein the substantially gaseous pyrolyzed hydrocarbon fluids are produced from a production well, the method further comprising heating a wellbore of the production well to inhibit condensation of the hydrocarbon fluids within the wellbore.

623. A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more heat sources to at least a portion of the formation;

allowing the heat to transfer from the one or more heat sources to a selected section of the formation to raise an average temperature within the selected section to, or above, a temperature that will pyrolyze hydrocarbons within the selected section;

producing a mixture from the formation; and

controlling a weight percentage of olefins of the produced mixture to be less than about 20 % by weight by controlling average pressure and average temperature in the selected section such that the average pressure in the selected section is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the selected section:

$$p = e^{[-57000/T + 83]}$$

where p is measured in psia and T is measured in ° Kelvin.

624. The method of claim 623, wherein the weight percentage of olefins of the produced mixture is controlled to be less than about 10 % by weight, and wherein the equation is:

$$p = e^{[-16000/T + 28]}.$$

625. The method of claim 623, wherein the weight percentage of olefins of the produced mixture is controlled to be less than about 5 % by weight, and wherein the equation is:

$$p = e^{[-12000/T + 22]}.$$

626. The method of claim 623, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

627. The method of claim 623, wherein the one or more heat sources comprise electrical heaters.

628. The method of claim 623, wherein the one or more heat sources comprise surface burners.

629. The method of claim 623, wherein the one or more heat sources comprise flameless distributed combustors.

630. The method of claim 623, wherein the one or more heat sources comprise natural distributed combustors.

631. The method of claim 623, further comprising controlling a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

632. The method of claim 631, wherein controlling an average temperature comprises maintaining a temperature within the selected section within a pyrolysis temperature range.

633. The method of claim 623, further comprising controlling the heat such that an average heating rate of the selected section is less than about 3.0 °C per day during pyrolysis.

634. The method of claim 623, further comprising controlling the heat such that an average heating rate of the selected section is less than about 1 °C per day during pyrolysis.

635. The method of claim 623, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein *Pwr* is the heating energy/day, *h* is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

636. The method of claim 623, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

637. The method of claim 623, wherein providing heat from the one or more heat sources comprises heating the selected formation such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C).

638. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

639. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

640. The method of claim 623, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

641. The method of claim 623, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

642. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

643. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

644. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

645. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

646. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

647. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

648. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

649. The method of claim 623, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

650. The method of claim 623, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises hydrogen,

wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

651. The method of claim 623, wherein the produced mixture comprises ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

652. The method of claim 623, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

653. The method of claim 623, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar.

654. The method of claim 623, wherein the partial pressure of H_2 is measured when the mixture is at a production well.

655. The method of claim 623, further comprising altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

656. The method of claim 623, wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation.

657. The method of claim 623, further comprising:

providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and

heating a portion of the section with heat from hydrogenation.

~~658. The method of claim 623, wherein the produced mixture comprises hydrogen and~~ condensable hydrocarbons, the method further comprising hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

659. The method of claim 623, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

660. The method of claim 623, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

661. The method of claim 623, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

662. The method of claim 623, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

663. The method of claim 623, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

664. The method of claim 623, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

~~665. A method of treating a hydrocarbon containing formation in situ, comprising:~~

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providing heat from one or more heat sources to at least a portion of the formation;

allowing the heat to transfer from the one or more heat sources to a selected section of the formation to raise an average temperature within the selected section to, or above, a temperature that will pyrolyze hydrocarbons within the selected section;

producing a mixture from the formation; and

controlling hydrocarbons having carbon numbers greater than 25 of the produced mixture to be less than about 25 % by weight by controlling average pressure and average temperature in the selected section such that the average pressure in the selected section is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the selected section:

$$p = e^{[-14000/T + 25]}$$

where p is measured in psia and T is measured in ° Kelvin.

666. The method of claim 662, wherein the hydrocarbons having carbon numbers greater than 25 of the produced mixture is controlled to be less than about 20 % by weight, and wherein the equation is:

$$p = e^{[-16000/T + 28]}.$$

667. The method of claim 662, wherein the hydrocarbons having carbon numbers greater than 25 of the produced mixture is controlled to be less than about 15 % by weight, and wherein the equation is:

$$p = e^{[-18000/T + 32]}.$$

668. The method of claim 662, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

669. The method of claim 662, wherein the one or more heat sources comprise electrical heaters.

670. The method of claim 662, wherein the one or more heat sources comprise surface burners.

671. The method of claim 662, wherein the one or more heat sources comprise flameless distributed combustors.

672. The method of claim 662, wherein the one or more heat sources comprise natural distributed combustors.

673. The method of claim 662, further comprising controlling a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

674. The method of claim 673, wherein controlling the temperature comprises maintaining a temperature within the selected section within a pyrolysis temperature range.

675. The method of claim 662, further comprising controlling the heat such that an average heating rate of the selected section is less than about 1 °C per day during pyrolysis.

676. The method of claim 662, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$Pwr = h*V*C_v*p_B$

wherein *Pwr* is the heating energy/day, *h* is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

677. The method of claim 662, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

678. The method of claim 662, wherein providing heat from the one or more heat sources comprises heating the selected section such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C).

679. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

680. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

681. The method of claim 662, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

682. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

683. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

684. ~~The method of claim 662, wherein the produced mixture comprises condensable~~ hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

685. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

686. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

687. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 3 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

688. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

689. The method of claim 662, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

690. The method of claim 662, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

691. ~~The method of claim 662, wherein the produced mixture comprises ammonia, and~~ wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

692. The method of claim 662, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

693. The method of claim 662, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar.

694. The method of claim 662, wherein the partial pressure of H_2 is measured when the mixture is at a production well.

695. The method of claim 662, further comprising altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

696. The method of claim 662, further comprising:

providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and

heating a portion of the section with heat from hydrogenation.

697. The method of claim 662, wherein the produced mixture comprises hydrogen and condensable hydrocarbons, the method further comprising hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

698. The method of claim 662, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 ~~millidarcy~~.

699. ~~The method of claim 662, wherein allowing the heat to transfer~~ comprises substantially uniformly increasing a permeability of a majority of the selected section.

700. The method of claim 662, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

701. The method of claim 662, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

702. The method of claim 662, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

703. The method of claim 662, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated ~~over an area of the formation to form a repetitive pattern of units.~~

704. A method of ~~treating a hydrocarbon containing~~ formation in situ, comprising:

providing heat from one or more heat sources to at least a portion of the formation;

allowing the heat to transfer from the one or more heat sources to a selected section of the formation to raise an average temperature within the selected section to, or above, a temperature that will pyrolyze hydrocarbons within the selected section;

producing a mixture from the formation; and

controlling an atomic hydrogen to carbon ratio of the produced mixture to be ~~greater than about 1.7 by controlling average pressure and average temperature in the~~

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selected section such that the average pressure in the selected section is greater than the pressure (p) set forth in the following equation for an assessed average temperature (T) in the selected section:

$$p = e^{[-38000/T + 61]}$$

where p is measured in psia and T is measured in ° Kelvin.

705. The method of claim 704, wherein the atomic hydrogen to carbon ratio of the produced mixture is controlled to be greater than about 1.8, and wherein the equation is:

$$p = e^{[-13000/T + 24]}.$$

706. The method of claim 704, wherein the atomic hydrogen to carbon ratio of the produced mixture is controlled to be greater than about 1.9, and wherein the equation is:

$$p = e^{[-8000/T + 18]}.$$

707. The method of claim 704, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

708. The method of claim 704, wherein the one or more heat sources comprise electrical heaters.

709. The method of claim 704, wherein the one or more heat sources comprise surface burners.

710. The method of claim 704, wherein the one or more heat sources comprise flameless distributed combustors.

711. The method of claim 704, wherein the one or more heat sources comprise natural distributed combustors.

712. The method of claim 704, further comprising controlling a temperature within at least a majority of the selected section of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

713. The method of claim 712, wherein controlling the temperature comprises maintaining a temperature within the selected section within a pyrolysis temperature range.

714. The method of claim 704, further comprising controlling the heat such that an average heating rate of the selected section is less than about 1 °C per day during pyrolysis.

715. The method of claim 704, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

716. The method of claim 704, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

717. The method of claim 704, wherein providing heat from the one or more heat sources comprises heating the selected section such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C).

718. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

719. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

720. The method of claim 704, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

721. The method of claim 704, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

722. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

723. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

724. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

~~725. The method of claim 704, wherein the produced mixture comprises condensable~~ hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

726. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

727. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

728. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

729. The method of claim 704, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

730. The method of claim 704, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

731. The method of claim 704, wherein the produced mixture comprises ammonia, and ~~wherein greater than about 0.05 % by weight of the produced mixture is ammo~~nia.

732. The method of claim 704, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

733. The method of claim 704, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar.

734. The method of claim 704, wherein the partial pressure of H_2 is measured when the mixture is at a production well.

735. The method of claim 704, further comprising altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

736. The method of claim 704, wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation.

737. The method of claim 704, further comprising:

providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and

heating a portion of the section with heat from hydrogenation.

738. The method of claim 704, wherein the produced mixture comprises hydrogen and condensable hydrocarbons, the method further comprising hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

739. The method of claim 704, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

740. The method of claim 704, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

741. The method of claim 704, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

742. The method of claim 704, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

743. The method of claim 704, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

744. The method of claim 704, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

745. A method of treating a hydrocarbon containing formation in situ, comprising:

providing heat from one or more heat sources to at least one portion of the formation;

allowing the heat to transfer from the one or more heat sources to a selected section of the formation;

controlling a pressure-temperature relationship within at least the selected section of the formation by selected energy input into the one or more heat sources and by pressure release from the selected section through wellbores of the one or more heat sources; and

producing a mixture from the formation.

746. The method of claim 745, wherein the one or more heat sources comprise at least two heat sources, and wherein superposition of heat from at least the two heat sources pyrolyzes at least some hydrocarbons within the selected section of the formation.

747. The method of claim 745, wherein the one or more heat sources comprise at least two heat sources.

748. The method of claim 745, wherein the one or more heat sources comprise surface burners.

749. The method of claim 745, wherein the one or more heat sources comprise flameless distributed combustors.

750. The method of claim 745, wherein the one or more heat sources comprise natural distributed combustors.

751. The method of claim 745, further comprising controlling the pressure-temperature relationship by controlling a rate of removal of fluid from the formation.

752. The method of claim 745, further comprising controlling the heat such that an average heating rate of the selected section is less than about 1 °C per day during pyrolysis.

753. The method of claim 745, wherein providing heat from the one or more heat sources to at least the portion of formation comprises:

heating a selected volume (V) of the hydrocarbon containing formation from the one or more heat sources, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than *Pwr*, wherein *Pwr* is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein *Pwr* is the heating energy/day, *h* is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

754. The method of claim 745, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

755. The method of claim 745, wherein providing heat from the one or more heat sources comprises heating the selected section such that a thermal conductivity of at least a portion of the selected section is greater than about 0.5 W/(m °C).

756. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

757. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

758. The method of claim 745, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the non-condensable hydrocarbons are olefins.

759. The method of claim 745, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

760. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

761. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

762. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

763. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

764. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

765. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

766. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

767. The method of claim 745, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

768. The method of claim 745, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises hydrogen, wherein the hydrogen is greater than about 10 % by volume of the non-condensable component, and wherein the hydrogen is less than about 80 % by volume of the non-condensable component.

769. The method of claim 745, wherein the produced mixture comprises ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

770. The method of claim 745, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

771. The method of claim 745, further comprising controlling a pressure within at least a majority of the selected section of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

772. The method of claim 745, further comprising controlling formation conditions to produce a mixture of hydrocarbon fluids and H_2, wherein the partial pressure of H_2 within the mixture is greater than about 0.5 bar.

773. The method of claim 745, further comprising controlling formation conditions to produce a mixture of condensable hydrocarbons and H_2, wherein a partial pressure of H_2 within the mixture is greater than about 0.5 bar.

774. ~~The method of claim 745, wherein the partial pressure of H_2 is measured when the mixture is at a production well.~~

775. The method of claim 745, further comprising altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

776. The method of claim 745, wherein controlling formation conditions comprises recirculating a portion of hydrogen from the mixture into the formation.

777. The method of claim 745, further comprising:

providing hydrogen (H_2) to the heated section to hydrogenate hydrocarbons within the section; and

heating a portion of the section with heat from hydrogenation.

778. The method of claim 745, wherein the produced mixture comprises hydrogen and condensable hydrocarbons, the method further comprising hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

779. The method of claim 745, wherein allowing the heat to transfer comprises increasing a permeability of a majority of the selected section to greater than about 100 millidarcy.

780. The method of claim 745, wherein allowing the heat to transfer comprises substantially uniformly increasing a permeability of a majority of the selected section.

781. The method of claim 745, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by the Fischer Assay.

782. The method of claim 745, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heat sources are disposed in the formation for each production well.

783. The method of claim 745, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, and wherein the unit of heat sources comprises a triangular pattern.

784. The method of claim 745, further comprising providing heat from three or more heat sources to at least a portion of the formation, wherein three or more of the heat sources are located in the formation in a unit of heat sources, wherein the unit of heat sources comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

785. A method of treating a hydrocarbon containing formation in situ, comprising:

heating a selected volume (V) of the hydrocarbon containing formation, wherein formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons within the selected volume of the formation; and

wherein heating energy/day provided to the volume is equal to or less than Pwr, wherein Pwr is calculated by the equation:

$$Pwr = h*V*C_v*\rho_B$$

wherein Pwr is the heating energy/day, h is an average heating rate of the formation, ρ_B is formation bulk density, and wherein the heating rate is less than about 10 °C/day.

786. The method of claim 785, wherein heating a selected volume comprises heating with an electrical heater.

787. The method of claim 785, wherein heating a selected volume comprises heating with a surface burner.

788. The method of claim 785, wherein heating a selected volume comprises heating with a flameless distributed combustor.

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